



# OPEN The relationship between personality dimensions and addiction type in women addicted to alcohol and opioids

Diana Rakić<sup>1</sup>, Nikola Lalović<sup>2,3</sup>✉, Jasmina Barišić<sup>2,3</sup>, Ivan Čelić<sup>4</sup> & Srdjan Milovanović<sup>2,3</sup>

Personality traits significantly influence the development, persistence, and treatment outcomes of substance use disorders. Despite increasing addiction rates among women, sex-specific research remains limited. This study explores the relationship between addiction type and personality traits among inpatient women addicted to alcohol and opioids. A cross-sectional design included three groups: 80 women with alcohol addiction, 80 with opioid addiction, and 80 healthy controls. Participants completed the Revised Temperament and Character Inventory (TCI-5-R) and the Revised NEO Personality Inventory (NEO-PI-R). One-way ANOVA assessed group differences, and canonical discriminant analysis predicted group affiliation. Women with opioid addiction showed a distinct and maladaptive personality profile on both inventories compared to women with alcohol addiction and healthy controls, whereas women with alcohol addiction more closely resembled controls. According to Cloninger's model, opioid-addicted women scored significantly higher on Novelty Seeking and Self-Transcendence, and lower on Self-Directedness and Cooperativeness ( $p < 0.001$ ). Within the Five-Factor Model, they also scored higher ( $p < 0.001$ ) on Neuroticism and lower on Agreeableness and Conscientiousness compared to alcohol-addicted women. Personality differences were more pronounced between women with opioid versus alcohol addiction than between alcohol-addicted women and healthy controls.

**Keywords** Women, Substance use disorders, Personality traits, TCI-5-R, NEOPI-R

Personality is one of the main focuses of research on addiction, for various reasons. First, certain personality traits (primarily temperament traits) have a strong hereditary component<sup>1</sup>. Thus, personality is an important mediator of genetic factors in the development of substance use disorders (SUD)<sup>2</sup>. Second, the relative stability of personality traits, or at least the predictable course of their change<sup>3,4</sup>, allows researchers to track the inter- and intragroup variability in the personality traits of people with addiction in a meaningful way. Finally, the choice of personality traits as the main research topic in addiction studies resides in the fact that extreme levels of personality traits (too high or too low in value) can create a tendency to develop comorbidities, poor therapeutic response, recidivism, and chronicity<sup>5–7</sup>. The greatest number of studies on the relationship between personality and SUD are based on *Cloninger's psychobiological model* and the *five-factor model of personality*<sup>8</sup>. Both models include the understanding of personality as a hierarchical, multidimensional construct that reflects relatively stable individual differences in affective, cognitive, and behavioral patterns, influenced by both biological and environmental factors<sup>9,10</sup>.

The seven-factor *psychobiological model* of personality, integrates findings from family and longitudinal developmental studies, psychometric research, and neurobiological investigations in both animals and humans<sup>9,11</sup>. The model conceptualizes personality as an interaction between four temperament dimensions—innate and biologically based—and three character dimensions, shaped through social learning and cognitive development. Temperament dimensions include:

<sup>1</sup>Special Hospital for Addiction Disorders, Belgrade, Serbia. <sup>2</sup>Clinic for Psychiatry, University Clinical Center of Serbia, Pasterova 2, Belgrade 11000, Serbia. <sup>3</sup>Faculty of Medicine, University of Belgrade, Belgrade, Serbia. <sup>4</sup>Department of Dual Diagnosis, University Psychiatric Hospital Vrapče, Zagreb, Croatia. ✉email: nikola.lalovic@med.bg.ac.rs

- *Novelty Seeking*: A dopaminergic system-based tendency to initiate behavior in response to novelty, reward signals, or cues for potential excitement. High NS individuals are curious, impulsive, enthusiastic, and disorganized.
- *Harm Avoidance*: A serotonin-related predisposition to inhibit behavior in response to punishment or uncertainty. High HA is associated with shyness, pessimism, anxiety, and fatigue.
- *Reward Dependence*: Reflecting noradrenergic sensitivity to social rewards, high RD is associated with warmth, attachment, sentimentality, and dependence on approval.
- *Persistence*: The ability to persevere despite frustration or fatigue, now considered an independent trait. High P individuals are industrious, perfectionistic, and ambitious.

The three character traits represent aspects of self-concept:

- *Self-Directedness (SD)*: Reflects an individual's capacity for self-regulation, responsibility, and goal orientation. High SD indicates maturity, self-determination, and the ability to adapt behavior to personal goals and values.
- *Cooperativeness (C)*: Describes the tendency to identify with and accept others. High C individuals are empathetic, tolerant, and helpful, in contrast to those who are self-centered and antagonistic.
- *Self-Transcendence (ST)*: Captures spiritual maturity and the capacity for transpersonal identification. High ST individuals experience themselves as integral parts of a greater whole and report feelings of connectedness and intuitive insight.

The Temperament and Character Inventory-Revised (TCI-R)<sup>12</sup> operationalizes these seven personality dimensions with strong psychometric properties, including good internal consistency, factorial validity, and cross-cultural applicability<sup>13–15</sup>. It is widely used in research on substance use disorders and relevant studies repeatedly confirm Novelty seeking as a more pronounced personality trait of people with addiction in general<sup>15–17</sup>, while high Harm avoidance in combination with high Novelty seeking is a risk factor for alcoholism<sup>18,19</sup>.

The *Five-Factor Model (FFM)* of personality, also known as the Big Five, is the most extensively validated and widely accepted dimensional model of personality structure. It describes five broad, biologically influenced domains that capture stable patterns of thoughts, emotions, and behavior. Each of the five domains is composed of six more specific *facets*, allowing fine-grained personality profiling:

- *Neuroticism* reflects emotional instability and sensitivity to negative stimuli. High scores are associated with a tendency toward anxiety, depression, and emotional reactivity.
- *Extraversion* represents a proclivity for sociability, assertiveness, and positive affect. Individuals high in Extraversion are active, talkative, and seek stimulation.
- *Openness to Experience* describes cognitive flexibility and openness to new ideas and experiences. High scorers tend to be imaginative, curious, and open-minded.
- *Agreeableness* reflects prosocial tendencies such as empathy, trust, and cooperation. Highly agreeable individuals are altruistic, modest, and compassionate.
- *Conscientiousness* captures self-discipline, goal orientation, and reliability. High Conscientiousness is associated with persistence, organization, and responsibility.

The model has demonstrated robust cross-cultural validity in over 50 nations and populations and is supported by behavioral genetic studies showing heritability estimates between 50% and 79%. FFM traits show remarkable long-term stability, particularly after the age of 30<sup>10,20</sup>. Numerous studies, employing the FFM in addiction research, have identified high scores on the Neuroticism dimension and low scores on Conscientiousness as defining characteristics of people addicted to opioids and/or alcohol<sup>18,21–29</sup>. Furthermore, a study conducted in a Serbian clinical population reported that women with opioid use disorder scored significantly higher on Neuroticism and lower on Conscientiousness compared to women with alcohol use disorder<sup>30</sup>.

### Sources of variability in research on the personalities of addicted individuals

Certain variables, outside the space of applied personality models, are important to consider when interpreting the results of research on the personalities of addicted individuals. For example, the temperament dimension of Novelty seeking has been repeatedly confirmed as a general risk factor for the development of SUD<sup>15–17,31</sup>. However, the expression of this trait is significantly affected by the age, type (clinical/nonclinical) of the studied population and severity of addiction<sup>16,32,33</sup>.

Similar sources of variability have been documented across the dimensions of the Five-Factor Model. Normative developmental research demonstrates that Conscientiousness and Agreeableness tend to increase throughout adulthood, while Neuroticism and Excitement-Seeking (a facet of Extraversion) tend to decline<sup>34,35</sup>. Furthermore, lower socioeconomic status has been associated with a personality profile marked by higher Neuroticism and lower levels of Conscientiousness and Openness to Experience<sup>36,37</sup>. Additionally, variations in personality profiles have been linked to addiction severity and type. For example, individuals with more severe SUDs often exhibit more pronounced elevations in Neuroticism and lower Conscientiousness, while different substances may be associated with distinct trait patterns<sup>23,38</sup>. This underscores the critical need to account for socio-demographic variables (e.g., age, socioeconomic status) and clinical characteristics (e.g., addiction severity and substance type) to accurately interpret Five-Factor Model personality traits in addiction research.

### Female sex and addiction

Sex differences in SUD, according to Becker and associates<sup>39</sup>, reflect the complex interactions between neurobiologically based sex differences and the effects of sociocultural factors. Historically, these differences were largely overlooked, with most research conducted in male populations, predominantly among men with

alcohol use disorders. Although contemporary epidemiological studies unequivocally indicate an increase in the incidence and prevalence of SUD in women<sup>40</sup>, especially during pregnancy<sup>41,42</sup> the number of sex-sensitive studies in this field is disproportionately small.

This gap in research is problematic given the evidence that women differ from men in both their vulnerability to and experience of addiction. Women tend to escalate drug use more rapidly and are more susceptible to long-term health complications associated with substance use<sup>39,43</sup>. Withdrawal profiles also vary: during drug abstinence, women experience more intense symptoms than men, whereas alcohol withdrawal in women often presents with milder clinical features<sup>44</sup>.

In addition to biological vulnerability, women with SUD face considerable sociocultural burdens. Difficulties in fulfilling socially expected roles, particularly those related to motherhood and caregiving, increase the stigma surrounding SUD in women<sup>39,45</sup>. Many women lack supportive networks, often due to abusive relationships or partners who also misuse substances<sup>46</sup>. These conditions contribute to elevated stress sensitivity and a higher risk of relapse<sup>39</sup>. Economic inequalities—reflected in lower employment rates and income levels—further limit women's access to treatment services<sup>47</sup>. As a result, women often seek professional help at more advanced stages of addiction, presenting with more severe physical and psychosocial consequences<sup>16,48</sup>. These intersecting challenges affect not only access to treatment but also adherence and long-term recovery<sup>46</sup>.

## Research question

The primary objective of this study was to examine whether significant differences exist in personality profiles among three groups of women—those with alcohol use disorder (AUD), those with opioid use disorder (OUD), and healthy controls (HCs) — by employing two widely recognized theoretical frameworks: the Five-Factor Model and Cloninger's psychobiological model of personality. A secondary objective was to investigate whether a composite of selected personality dimensions could reliably differentiate group membership (AUD, OUD, or HCs).

### Hypotheses

1. Significant differences will be observed among the three groups (AUD, OUD, and HCs) across the investigated personality dimensions, specifically in the temperament and character traits outlined by Cloninger's psychobiological model, as well as the basic personality dimensions defined by the Five-Factor Model.
2. A multivariate combination of personality dimensions will significantly and consistently differentiate women with AUD, women with OUD, and healthy controls.

## Methods

The research was conducted as a cross-sectional study. The sample consisted of women addicted to alcohol and opioids, and treated at the Special Hospital for Addiction Disorders in Belgrade (a specialized inpatient facility offering both detoxification and initial rehabilitation) from June 2014 - February 2016. The inclusion criteria for women treated for SUD in this study were 26–50 years of age and a confirmed diagnosis of alcohol and opioid use disorder (based on the ICD-10 classification criteria). Furthermore, the inclusion criteria also comprised an established abstinence from alcohol i.e. opioids for at least 10 days before entering the research study. This duration was selected based on clinical guidelines indicating that acute withdrawal symptoms typically subside within the first 7–10 days, allowing for a more stable emotional and cognitive state at the time of psychometric assessment. Abstinence was verified through a combination of toxicological urine screening and continuous clinical monitoring by trained psychiatric staff during inpatient treatment.

The study did not include subjects with unstable somatic or neurological conditions that may impair cognitive functioning and the validity of psychological assessments, such as epilepsy, traumatic brain injury, neurodegenerative diseases, or decompensated hepatic insufficiency, a comorbid SUD, or psychiatric comorbidities (schizophrenia-spectrum disorders, unipolar or bipolar affective disorders, anxiety disorders, and organic mental disorders). This applied to both the subjects from the clinical sample and the subjects from the control group.

The control group consisted of women from the general population of [withheld for review], selected via random sampling from the database of all residential subscribers of fixed telephony, provided that they have no history of abuse/addiction to alcohol and drugs, nor do they currently abuse these substances. All participation was voluntary and conducted under institutional ethical approval without financial compensation. Based on these inclusion and exclusion criteria, three samples of equal size ( $N = 80$ ) were formed - women with (AUD), women with (OUD), and a sample of women from the nonclinical population with no history of abuse/addiction, i.e. healthy controls (HCs). To detect a statistically significant difference among the three groups at an alpha level of 0.05 and a statistical power of 0.80, a sample size of 76 participants per group was required to identify significant differences in at least five out of the seven measured dimensions<sup>49</sup>.

Data were collected on the respondents' age, educational level, professional status, marital status, and number of children via semi-structured interviews. This questionnaire included questions about somatic, neurological, and psychiatric status; personal and family history of drug and alcohol abuse/addiction.

To assess the personalities of the respondents, the revised Temperament and Character Inventory (The Temperament and Character Inventory-5-Revised; TCI-5-R)<sup>12</sup>, a self-report questionnaire based on Cloninger's psychobiological personality model<sup>50</sup>, and the revised Neuroticism Extraversion Openness Personality Inventory (Neuroticism, Extraversion, Openness Personality Inventory-Revised; NEO PI-R)<sup>51</sup>, which is based on the Five-factor model of personality<sup>52</sup>, were used.

The TCI-R evaluates seven dimensions of personality, comprising four temperament dimensions—Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD), and Persistence (P)—and three character dimensions—Self-Directedness (SD), Cooperativeness (C), and Self-Transcendence (ST).

Each broad dimension consists of several narrower facets:

- *NS*: Exploratory Excitability-Rigidity, Impulsiveness-Reflection, Extravagance-Reserve, Disorderliness-Determination.
- *HA*: Anticipatory Worry-Optimism, Fear of Uncertainty-Confidence, Shyness-Inhibition, Fatigability-Vigor.
- *RD*: Sentimentality-Indifference, Attachment-Detachment, Dependence-Independence.
- *P*: Industriousness-Laziness, Work Hardened-Susceptible, Ambitious-Unmotivated, Perfectionism-Pragmatism.
- *SD*: Responsibility-Blaming, Purposefulness-Helplessness, Resourcefulness-Passivity, Self-Acceptance-Self-Striving, Congruent Second Nature-Incongruence.
- *C*: Social Acceptance-Intolerance, Empathy-Indifference, Helpfulness-Unwillingness, Compassion-Cruelty, Principles-Selfishness.
- *ST*: Self-Forgetfulness-Self-Awareness, Transpersonal Identification-Isolation, Spiritual Acceptance-Materialism.

The instrument contains 240 items rated on a 5-point Likert scale, ranging from 1 (definitely false) to 5 (definitely true). The Serbian standardized version of the TCI-R was employed, validated on our population<sup>14</sup>.

The TCI-R demonstrates satisfactory reliability and validity in both international and local contexts. Internal consistency (Cronbach's alpha) for the broad temperament and character dimensions typically ranges from 0.70 to 0.85, with facet-level alphas varying owing to fewer items per scale but generally acceptable for research purposes. Test-retest reliability coefficients over several weeks to months commonly exceed 0.70, indicating good temporal stability<sup>12,13</sup>.

The NEOPI-R<sup>51</sup> evaluates five broad personality domains: Neuroticism (N), Extraversion (E), Openness to Experience (O), Agreeableness (A), and Conscientiousness (C). Each domain consists of six distinct facets, with each facet represented by eight items, enabling a comprehensive assessment of personality traits.

The facets under each domain include:

- *N*: Anxiety, Hostility, Depression, Self-Consciousness, Impulsiveness, Vulnerability.
- *E*: Warmth, Gregariousness, Assertiveness, Activity, Excitement-Seeking, Positive Emotions.
- *O*: Fantasy, Aesthetics, Feelings, Actions, Ideas, Values.
- *A*: Trust, Straightforwardness, Altruism, Compliance, Modesty, Tender-Mindedness.
- *C*: Competence, Order, Dutifulness, Achievement Striving, Self-Discipline, Deliberation.

It comprises 240 items rated on a 5-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree). For example, items include statements such as "I often feel tense or jittery" (Neuroticism: anxiety) and "I am organized and thorough" (Conscientiousness: competence), which participants respond to according to their degree of agreement.

The NEO PI-R has demonstrated excellent psychometric qualities in both international and local contexts. In this sample, internal consistency coefficients (Cronbach's alpha) for the five domains ranged from 0.86 to 0.92, indicating high reliability, while facet scales showed acceptable reliability between 0.54 and 0.83, consistent with previous research. Test-retest reliabilities for domain scores typically exceed 0.80 over multiple years, supporting the temporal stability of measured traits. Validity evidence includes strong convergent and discriminant validity confirmed across diverse populations. The standardized Serbian version applied here<sup>53</sup>.

After the goal and procedure of the study were clarified to the respondents and written consent for participation was obtained, semi-structured interview and the stated questionnaires were applied.

Group differences in sociodemographic characteristics were assessed with chi-square tests, and differences in personality dimensions scores were evaluated using one-way ANOVA with post-hoc Šidák tests for pairwise comparisons. The influence of specific sociodemographic confounders was further examined using one-way analysis of covariance (ANCOVA). To comprehensively adjust for multiple potential confounders, we employed multivariable linear regression models controlling for age, education, marital status, employment status, number of children, and family psychiatric history. Lastly, the ability of the personality dimensions to predict group affiliation was tested via canonical discriminant analysis (CDA).

## Results

### Sample structure

As shown in Table 1, the three groups of respondents differed significantly across all the examined sociodemographic characteristics.

ANOVA revealed significant differences ( $F = 35.85$ ,  $p < 0.001$ ) in mean age: AUD group had the highest ( $43.17 \pm 6.03$ ), HCs followed ( $37.50 \pm 9.21$ ), and OUD group had the lowest ( $33.99 \pm 4.76$ ), with post hoc Tukey tests confirming significant pairwise differences (Supplementary Table S1). Pairwise comparisons further showed that women with OUD differed significantly from both AUD and HC groups in education level and employment status, having lower education levels and higher unemployment (Supplementary Table S2). Marital status and number of children also differed significantly between the AUD group and both OUD and HC groups, with AUD women being less often single and less frequently without children compared to the other groups. Differences between the AUD group and HCs were significant for education level (with more university degrees in the AUD group), but not significant for employment status. A positive family history of SUD was significantly more common in both clinical samples than in the HCs (20%) with no significant difference between OUD (69%) and AUD (66%).

Variable	Study groups			p-value
	Women with opioid use disorder (n = 80)	Women with alcohol use disorder (n = 80)	Healthy controls (n = 80)	
Current age (years)				
Mean ± SD	33.99 ± 4.76	43.17 ± 6.03	37.50 ± 9.21	< 0.001 <sup>b</sup>
Range	26–46	29–51	26–51	
Education level (years), No (%)				
Primary (1–8)	13 (16.25)	1 (1.25)	1 (1.25)	< 0.001 <sup>c</sup>
Secondary (9–12)	61 (76.25)	46 (57.50)	63 (78.75)	
University (13+)	6 (7.50)	32 (40.00)	16 (20.00)	
Current employment status, No (%)				
Employed	62 (77.50)	28 (35.00)	25 (31.25)	< 0.001 <sup>c</sup>
Unemployed <sup>a</sup>	18 (22.50)	52 (65.00)	55 (68.75)	
Marital status, No (%)				
Single (never married) <sup>a</sup>	46 (57.50)	16 (20.00)	34 (42.50)	< 0.001 <sup>c</sup>
Married/cohabiting	18 (22.50)	38 (47.50)	31 (38.75)	
Remarried	0 (0.00)	2 (2.50)	2 (2.50)	
Widowed	0 (0.00)	3 (3.75)	4 (5.00)	
Separated/divorced	16 (20.00)	21 (26.25)	9 (11.25)	
Number of children, No (%)				
Without child <sup>a</sup>	46 (57.50)	23 (28.75)	41 (51.25)	< 0.001 <sup>c</sup>
One child	25 (31.25)	25 (31.25)	16 (20.00)	
Two children	9 (11.25)	29 (36.25)	19 (23.75)	
Three children	0 (0.00)	3 (3.75)	4 (5.00)	
Family history				
Positive	55 (68.75)	53 (66.25)	16 (20.00)	< 0.001 <sup>c</sup>
Negative	25 (31.25)	27 (33.75)	64 (80.00)	

**Table 1.** Socio-demographic characteristics. <sup>a</sup>Reference category; <sup>b</sup>One-way ANOVA; <sup>c</sup>Chi-square tests.

Temperament and character dimensions	Study groups			F <sup>a</sup>	P value <sup>a</sup>
	Women with opioid use disorder (n = 80)	Women with alcohol use disorder (n = 80)	Healthy controls (n = 80)		
Novelty seeking Mean $\pm$ SD	114.14 $\pm$ 14.28**	104.05 $\pm$ 14.27	102.14 $\pm$ 13.32	17.058	< 0.001
HArm avoidance Mean $\pm$ SD	91.79 $\pm$ 15.75	93.32 $\pm$ 16.03	89.80 $\pm$ 14.46	1.050	0.352
Reward dependence Mean $\pm$ SD	164.50 $\pm$ 10.50	162.79 $\pm$ 12.14	162.72 $\pm$ 11.18	0.637	0.530
Persistence Mean $\pm$ SD	121.47 $\pm$ 18.88	118.51 $\pm$ 21.35	116.01 $\pm$ 18.55	1.552	0.214
Self-directedness Mean $\pm$ SD	111.89 $\pm$ 18.98**	132.42 $\pm$ 20.96	136.90 $\pm$ 17.46	38.656	< 0.001
Cooperativeness Mean $\pm$ SD	122.42 $\pm$ 16.11**	129.34 $\pm$ 13.61	131.51 $\pm$ 13.81	8.498	< 0.001
Self-transcendence Mean $\pm$ SD	87.79 $\pm$ 14.41**	74.47 $\pm$ 13.84	72.41 $\pm$ 16.41	25.002	< 0.001

**Table 2.** Descriptive characteristics of study groups on temperament and character dimensions. <sup>a</sup>ANOVA test. \*Tukey's test  $p < 0.05$  compared to controls. \*\*Tukey's test  $p < 0.01$  compared to controls.

### Dimensions of psychobiological model

The mean values of the TCI-R dimensions for the three groups of respondents, as well as the significance of differences between groups, are shown in Tables 2 and 3.

Concerning temperament traits, a significant difference was observed only in Novelty Seeking. Compared to women with AUD and HCs, women with OUD showed significantly higher scores in this domain. Although women with AUD, compared to HCs, showed a higher mean score for Novelty Seeking, the difference was not statistically significant.

At the level of character traits, significant differences were detected in the dimensions of Self-Directedness, Cooperativeness, and Self-Transcendence. Women with OUD attained significantly lower scores on Self-Directedness and Cooperativeness, and higher scores on Self-Transcendence compared to women with AUD and HCs. Women with AUD scored similarly to the control group on these dimensions, with no statistically significant differences observed. Post hoc power analysis was conducted for all TCI-R personality traits, including those without statistically significant group differences. Large effect sizes and high statistical power were observed for comparisons involving Novelty Seeking (OUD vs. HC:  $d = 0.87$ , power = 1.00; OUD vs. AUD:  $d = 0.71$ , power = 0.99) and Self-Directedness (OUD vs. HC:  $d = 1.37$ , power = 1.00; OUD vs. AUD:  $d = 1.03$ , power = 1.00). Moderate effects were found for Cooperativeness (OUD vs. AUD:  $d = 0.61$ , power = 0.97) and



TCI-R dimension	Comparison	Mean diff.	Std. error	p-value	Cohen's d [95% CI]	Statistical power (%)
Novelty seeking	ODD vs. HC	12.00*	2.21	<0.001	0.87 [0.56, 1.18]	100
	ODD vs. AUD	10.09*	2.21	<0.001	0.71 [0.41, 1.01]	99
	AUD vs. HC	1.91	2.21	0.77	0.14 [-0.16, 0.44]	14
Harm avoidance	ODD vs. HC	1.99	2.44	0.80	0.13 [-0.17, 0.43]	13
	ODD vs. AUD	-1.54	2.44	0.90	-0.10 [-0.40, 0.20]	9
	AUD vs. HC	3.52	2.44	0.39	0.23 [-0.07, 0.53]	31
Reward dependence	ODD vs. HC	1.78	1.79	0.69	0.16 [-0.14, 0.46]	18
	ODD vs. AUD	1.71	1.79	0.71	0.15 [-0.15, 0.45]	16
	AUD vs. HC	0.06	1.79	1.00	0.01 [-0.29, 0.31]	5
Persistence	ODD vs. HC	5.46	3.10	0.22	0.29 [-0.01, 0.59]	45
	ODD vs. AUD	2.96	3.10	0.71	0.15 [-0.15, 0.45]	15
	AUD vs. HC	2.50	3.10	0.81	0.13 [-0.17, 0.43]	12
Self-directedness	ODD vs. HC	-25.01*	3.03	<0.001	-1.37 [-1.69, -1.05]	100
	ODD vs. AUD	-20.54*	3.03	<0.001	-1.03 [-1.35, -0.71]	100
	AUD vs. HC	-4.48	3.03	0.37	-0.23 [-0.55, 0.09]	31
Cooperativeness	ODD vs. HC	-6.91*	2.30	0.009	-0.46 [-0.77, -0.15]	83
	ODD vs. AUD	-9.09*	2.30	<0.001	-0.61 [-0.92, -0.30]	97
	AUD vs. HC	2.18	2.30	0.72	0.16 [-0.15, 0.46]	17
Self-transcendence	ODD vs. HC		2.36	<0.001	1.00 [0.68, 1.32]	100
	ODD vs. AUD		2.36	<0.001	0.94 [0.62, 1.26]	99
	AUD vs. HC		2.36	0.77	0.14 [-0.16, 0.44]	14

**Table 3.** Sidak post hoc pairwise comparisons of TCI-R dimensions: effect sizes and Power. \*Indicates statistical significance at  $p < 0.05$ ; OUD = Women with Opioid Use Disorder, AUD = Women with Alcohol Use Disorder, HC = Healthy Controls; Statistical power calculated for  $\alpha = 0.05$ , two-tailed tests.

Self-Transcendence (OUD vs. HC:  $d = 1.00$ , power = 1.00). In contrast, traits such as Harm Avoidance, Reward Dependence, and Persistence showed small effect sizes ( $d < 0.30$ ) and correspondingly low statistical power, indicating limited ability to detect differences in these domains given the present sample size.

Additionally, a one-way analysis of covariance (ANCOVA) was conducted to examine differences in TCI-R personality traits among the three participant groups, using year of birth as a covariate. After controlling for age, all previously observed between-group differences in personality dimensions remained significant. In multivariable linear regression models, other sociodemographic factors—marital status, education, employment, number of children, and family history of mental illness—were not significant predictors of personality dimensions after adjustment for substance-use group (Supplementary Table S3).

A CDA was used to test the possibility of predicting group affiliation based on temperament and character traits (Supplementary Table S4). A single significant function emerged ( $\Lambda = 0.629$ ,  $\chi^2(14) = 108.43$ ,  $p < 0.001$ ), explaining 93% of the discriminant variance. This function was mainly defined by lower Self-Directedness ( $r = -0.785$ ) and higher Self-Transcendence ( $r = 0.631$ ) and Novelty Seeking ( $r = 0.522$ ) (Supplementary Table S5). Group centroids showed that women with OUD (1.007) were clearly separated from HCs (-0.655) and women with AUD (-0.352), with distances of approximately 1.66 and 1.36 standard deviations, respectively, whereas the AUD group was located nearer to the HCs ( $\approx 0.30$  SD) (Supplementary Table S6). Based on this function, 57.1% of the cases were successfully classified (Supplementary Table S7).

#### Dimensions of FFM

One-way ANOVA revealed significant differences in mean scores across all five FFM dimensions among the three groups: women with OUD, AUD, and HC (Table 4). Post hoc pairwise comparisons showed that women with OUD scored significantly higher ( $p < 0.001$ ) on Neuroticism compared to both the AUD and HC groups, with medium-to-large ( $d = 0.61$ ) and large effect sizes ( $d = 0.91$ ), respectively. Similarly, mean scores for Agreeableness and Conscientiousness were significantly lower ( $p < 0.001$ ) in the OUD group compared to both the AUD group and HCs, also medium-to-large ( $d = 0.71$  and  $0.65$ ) and large effect sizes ( $d = 0.87$  and  $0.83$ ), respectively.

In the Extraversion domain, women with OUD scored higher than those with AUD ( $d = 0.57$ ;  $p = 0.001$ ), but did not differ significantly from HCs. For Openness to Experience, significant differences favored the OUD group compared to HCs (medium effect sizes:  $d = 0.53$ ;  $p = 0.003$ ), but did not differ significantly from women with AUD (Table 5). At the dimensional level, AUD patients did not differ significantly from healthy controls. In contrast, post-hoc facet analyses within Neuroticism indicated significant differences for Depression ( $p = 0.001$ ,  $d = 0.39$ , 95% CI [0.09, 0.69]) and Self-Conscientiousness ( $p = 0.004$ ,  $d = 0.26$ , 95% CI [-0.04, 0.56]). Across most dimensions, women with AUD occupied an intermediate position between women with OUD and HCs, with the exception of Extraversion, where they scored lowest among the three groups. Statistical power exceeded 90% for most significant comparisons, ensuring robust detection of large effects, whereas lower power was observed for non-significant differences. After controlling for age, all previously observed group differences in personality dimensions remained statistically significant, except for Extraversion. Multivariate linear regression analyses

NEO PI-R domains	Study groups			F <sup>a</sup>	p-value <sup>a</sup>
	Women with opioid use disorder (n = 80)	Women with alcohol use disorder (n = 80)	Healthy controls (n = 80)		
NEUROTICISM Mean ± SD	157.99 ± 21.45**	144.90 ± 21.74	139.38 ± 19.41	16.743	< 0.001
EXTRAVERSION Mean ± SD	161.54 ± 15.64	151.75 ± 18.59	156.79 ± 17.39	6.441	0.002
OPENNESS TO EXPERIENCE Mean ± SD	168.58 ± 16.20*	162.61 ± 18.52	159.25 ± 18.93	5.553	0.004
AGREEABLENESS Mean ± SD	151.72 ± 14.55**	162.72 ± 16.43	163.81 ± 13.19	16.368	< 0.001
CONSCIENTIOUSNESS Mean ± SD	149.88 ± 18.94**	162.90 ± 21.04	165.51 ± 18.84	14.074	< 0.001

**Table 4.** Descriptive characteristics of NEO PI-R domains of study groups. <sup>a</sup>ANOVA test. \*Tukey's test  $p < 0.01$  compared to controls; \*\*Tukey's test  $p < 0.001$  compared to controls.

NEO-PI-R dimension	Comparison	Mean difference	Std. error	p-value	Cohen's d [95% CI]	Statistical power (%)
Neuroticism	UD vs. HC	18.61*	3.30	< 0.001	0.91 [0.51, 1.31]	99.9
	UD vs. AUD	13.09*	3.30	< 0.001	0.61 [0.22, 0.99]	92.1
	AUD vs. HC	5.52	3.30	0.261	0.27 [-0.11, 0.65]	23.9
Extraversion	UD vs. HC	4.75	2.73	0.229	0.29 [-0.09, 0.67]	27.8
	UD vs. AUD	9.79*	2.73	0.001	0.57 [0.18, 0.96]	88.2
	AUD vs. HC	-5.04	2.73	0.185	-0.28 [-0.66, 0.10]	26.3
Openness to experience	UD vs. HC	9.32*	2.83	0.003	0.53 [0.14, 0.91]	82.4
	UD vs. AUD	5.96	2.83	0.105	0.34 [-0.04, 0.72]	40.6
	AUD vs. HC	3.36	2.83	0.555	0.18 [-0.10, 0.56]	10.3
Agreeableness	UD vs. HC	-12.09*	2.34	< 0.001	-0.87 [-1.27, -0.48]	99.9
	UD vs. AUD	-11.00*	2.34	< 0.001	-0.71 [-1.10, -0.32]	98.0
	AUD vs. HC	-1.08	2.34	0.954	0.07 [-0.45, 0.30]	2.9
Conscientiousness	UD vs. HC	-15.64*	3.16	< 0.001	-0.83 [-1.22, -0.43]	99.7
	UD vs. AUD	-13.02*	3.16	< 0.001	-0.65 [-1.04, -0.26]	95.4
	AUD vs. HC	-2.61	3.16	0.793	-0.13 [-0.51, 0.25]	5.9

**Table 5.** Sidak post hoc pairwise comparisons of NEO PI-R domains: effect sizes and power. \*Indicates statistical significance at  $p < 0.05$ ; UD = Women with Opioid Use Disorder, AUD = Women with Alcohol Use Disorder, HC = Healthy Controls; Statistical power calculated for  $\alpha = 0.05$ , two-tailed tests.

indicated that other sociodemographic factors, including marital status, education, employment, number of children, and family history of mental illness, exerted non-significant effects on NEO-PI-R dimensions when substance use group was accounted for in the model (Supplementary Tables S8).

A CDA was utilized to test the possibility of predicting group affiliation based on the dimensions of the basic structure of personality (Supplementary Tables S9 and S10).

Two discriminant functions were obtained, of which only the first (Function 1) was statistically significant ( $\Lambda = 0.709$ ,  $\chi^2(10) = 80.98$ ,  $p < 0.001$ ). This function was defined by higher Neuroticism ( $r = 0.615$ ) and lower Agreeableness ( $r = -0.615$ ) and Conscientiousness ( $r = -0.571$ ), with a smaller positive contribution of Openness ( $r = 0.349$ ). Women with UD were located at the positive pole of Function 1 (centroid = 0.841), whereas healthy controls (HCs) were located at the negative pole (centroid = -0.520), representing a distance of approximately 1.3 standard deviations. Women with AUD (centroid = -0.321) were positioned closer to HCs than to women with UD (Supplementary Table S11). Based on this function, 56.7% of cases were correctly classified (Supplementary Table S12).

## Discussion

### Women with opioid use disorder

Women with UD are predominantly younger, unmarried, childless, less educated, and unemployed. The earlier onset of UD is an expected finding. In fact, unlike men, women, owing to greater biological sensitivity, tend to progress faster from initial experiences with opioids to the development of an addiction<sup>39</sup>. Earlier onset of this form of addiction may also suggest a greater genetic burden, which is a common finding in opioid-related disorders<sup>54</sup>. This finding is supported by our research, which detected a significantly higher rate of prevalence of family history of SUDs in this group of respondents.

### Women with alcohol use disorder

Compared to women with OUD and HCs, women with AUD were characterized by greater average age, higher levels of education, and higher employment rates. In addition, this group had the highest number of married respondents, while simultaneously they showed greater marital instability; i.e., in this group the tendency towards separation and divorce was by far the most common. This may be one of the reasons why they have fewer children than women do in HCs. Instability in partnerships or marital relationships can be a source of intense stress, where alcohol use disorders have a symptomatic function<sup>44,46</sup>. However, due to the cross-sectional design of this study, it is not possible to determine whether such instability is a cause or a consequence of the disorder.

In terms of personality dimensions, the success of the classification of respondents (AUD, OUD, or HC) based on applied personality inventories was similar – 57.1% for the TCI-5-R and 56.7% for the NEO PI-R. This gives researchers and practitioners a certain degree of freedom in choosing instruments or models of personality in research, evaluation, and treatment.

### Cloninger's psychobiological model of personality

According to the results of our study, the three groups of respondents differ in the dimensions of Novelty Seeking (temperament dimension) as well as all three character dimensions: Self-Directedness, Cooperativeness, and Self-Transcendence. Moreover, women with OUD have significantly higher scores on the Novelty seeking and Self-Transcendence dimensions, and significantly lower scores on the Self-Directedness and Cooperativeness dimensions, compared to the other two groups. The results of the CDA suggest that women with OUD can be clearly distinguished from both healthy controls and women with AUD on the basis of specific personality profile characterized by lower Self-Directedness in combination with higher Self-Transcendence and higher Novelty Seeking. In contrast, women with AUD were positioned closer to healthy controls, with substantially smaller differences, suggesting that their personality structure may not deviate as markedly from non-clinical populations.

The results of relevant studies consistently show that temperament dimension of Novelty Seeking - is a general risk factor for the development of addiction<sup>15</sup>. Our findings partially align with previous research reporting significantly higher scores in Novelty Seeking and Self-Transcendence and significantly lower scores in Self-Directedness among individuals with OUD compared to both alcohol-dependent individuals and healthy controls<sup>19</sup>. However, unlike Milivojević et al., who also identified a significant difference in mean scores of Reward Dependence and Harm Avoidance between the groups, which we did not observe. Additionally, while they found significantly higher Novelty Seeking in individuals with alcohol use disorder compared to controls, in our sample this difference was not statistically significant. A post-hoc power analysis suggests that the absence of statistically significant differences for these traits may be partly attributable to insufficient sample size rather than the absence of a true effect. However, compared to earlier similar study<sup>30</sup>, with an increase in sample size in this study, a convergence of personality characteristics of women with AUD and HCs was noted.

In our sample, women with AUD predominantly displayed Type 1 characteristics as defined by Cloninger's typology of alcohol use disorder<sup>55</sup>, including older age, dependent personality traits, and heightened exposure to social stressors.

### The five-factor model of personality

Personality assessment of respondents, obtained by applying the FFM revealed statistically significant differences between women with OUD and women with AUD in four domains (all but Openness), and in four domains (all but Extraversion) between OUD patients and HCs. CDA further supported these findings, identifying one significant discriminant function characterized by high Neuroticism and low Agreeableness and Conscientiousness (with a smaller positive contribution of Openness), which clearly separated women with OUD from HCs, while AUD patients clustered closer to the control group.

These results are consistent with the findings of foreign studies on people with SUD<sup>21,25,55–58</sup>. After controlling for age, all previously observed differences in personality dimensions remained significant, except for Extraversion. Considering that additional analyses showed a significant, negative correlation between the scores on the Extraversion domain and the age of the respondents the lowest mean score of women with AUD were, in all likelihood, a reflection of the fact that the respondents were the oldest in this group. Previous studies have shown that Extraversion tends to be more pronounced in younger individuals with addiction, as well as in those with OUD, compared to individuals with AUD<sup>21,36</sup>. Moreover, within the CDA model, this domain did not contribute significantly to the discriminatory function. This suggests that the variation in Extraversion is more likely attributable to age differences among participants than to their group membership. Women with AUD exhibited significantly higher levels of Agreeableness and Conscientiousness compared to those with OUD, while demonstrating less pronounced Openness to Experience. In this respect, their personality profile more closely resembled that of HCs. Moreover, no significant differences were observed between women with AUD and HCs across any of the five personality domains. This finding contrasts with prior research<sup>30</sup>, which - using a smaller sample - reported significantly higher Neuroticism and lower Conscientiousness in women with AUD. This discrepancy may be attributable to differences in sample size and participant age across studies. However, women with AUD show some potential for psychological destabilization (an increase in the Neuroticism facets - Depression and Self-Consciousness). As this is a cross-sectional study, it is not possible to distinguish whether depression is a personality trait or a state, or if it is a state, whether it is a primary or secondary depressive disorder.



## Clinical implications

Finally, it is important to consider the expected therapeutic responses in light of the prominence of Neuroticism and Novelty Seeking, as these are the dimensions that most distinguished women with OUD in our research. An anxious, vulnerable, self-conscious, moody, depressed person who is high in the domain of Neuroticism, is inclined to see situations as stressful and is more vulnerable to stress and thus at greater risk of relapse<sup>59</sup>. Additionally, there is a positive correlation between Novelty Seeking and the tendency toward treatment dropout ahead of time or relapse<sup>17,32</sup> probably due to high impulsivity, risky behavior, poor self-control, and psychological vulnerability<sup>16</sup>.

A combined, psychopharmacological and psychotherapeutic approach, supplemented with social skills training, is recommended for women with OUD, with close monitoring for dropout and relapse. Being generally younger and exhibiting traits of immature, maladaptive personality organization, they require therapy focused on fostering developmental growth, self-esteem, and adaptive coping.

Women with AUD display greater maturity and better impulse control, which supports sustained engagement in therapy; however, their vulnerability and depressive traits, together with their older age and potentially greater physical health problems, make the therapeutic process not necessarily less complex.

## Limitations of the study

The clinical sample included women in specialized inpatient treatment, who may differ from those not seeking treatment in their level of insight into the disorder and motivation to address it, potentially reflecting a different constellation of personality traits. Consequently, findings may not generalize to broader populations, including untreated women with substance use disorders or at-risk women in the general population. Additionally, larger samples would enhance the reliability of results, particularly for finer-grained analyses of TCI and NEO PI-R facets. A post-hoc power analysis indicated that the study had adequate statistical power ( $\geq 0.80$ ) to detect medium-to-large effects for significant results. However, small differences may have been underestimated due to limited statistical power, suggesting that some non-significant findings could reflect insufficient sample size rather than the absence of a true effect.

This cross-sectional design precludes causal inference and limits the feasibility of mediation analyses. Temporal ordering among key variables cannot be established; thus, we cannot determine whether being without a partner among women with OUD is a cause or consequence of addiction, whether partner/marital instability predisposes to or results from alcohol misuse, or whether professional/educational stress precipitates or follows addictive patterns. In addition, moderation (interaction) tests were not preregistered, and were not part of the primary analysis.

One notable limitation of this study is the relatively short abstinence period (7–10 days) prior to psychometric testing. While major guidelines (e.g., UNODC/WHO, NICE) emphasize the importance of conducting assessments during abstinence and clinical stability, they do not specify a precise minimum duration for personality testing<sup>60–62</sup>. Although acute withdrawal symptoms are typically resolved within 1–2 weeks, post-acute withdrawal syndrome (PAWS)—characterized by persistent emotional and cognitive disturbances—can last for several months<sup>63–65</sup>. Consequently, it is highly likely that some of the observed elevations in Neuroticism and impulsivity scores among women with OUD reflect transient withdrawal-related affective states rather than stable personality traits. Indeed, with prolonged abstinence, lower scores might be expected, as suggested by prior research<sup>66,67</sup>. This limitation should be carefully considered when interpreting the results, and future studies with longer abstinence periods are warranted to validate these findings.

Furthermore, while formal comorbid psychiatric diagnoses were an exclusion criterion, the study did not employ screening tools to assess for subclinical symptoms of mood or anxiety disorders. Such subclinical symptoms are common in SUD populations and could potentially influence personality test scores. We recommend that future research include standardized symptom measures to better control for this potential confounding factor.

Finally, the generalizability of our findings is limited by the focus on only two SUDs (alcohol and opioids). We did not collect systematic pharmacotherapy data (medication class, dose, and timing relative to assessment) or detailed treatment histories, nor did we assess psychiatric comorbidity with standardized diagnostic tools. As a result, potential effects of medication exposure and clinical history on personality scores remain unaccounted for. Future studies should include a broader range of SUDs and incorporate standardized diagnostic assessments and detailed treatment-history and pharmacotherapy measures to better control clinical confounding.

## Conclusion

The results from this research confirm the expected differences in the personality dimensions of women with opioid and alcohol use disorders, revealing that the dissimilarities between those two groups are much greater than those between women with alcohol use disorders and healthy women. Independent of the personality inventory used, consistent results were obtained, and the TCI-5-R and NEO PI-R were similarly successful in the classification of respondents (AUD, OUD, or HCs). Women with OUD are younger, with a constellation of character and temperament traits that point to immature and maladaptive personality organization. Women with AUD are more mature, but still vulnerable due to their neurotic personality structure, with dependent traits including traits characteristic of dependent personality - such as submissiveness, need for reassurance, and interpersonal dependency- accompanied by depressive symptoms, and multiple sources of social distress. These findings highlight the importance of considering substance-specific personality profiles in clinical assessment and treatment planning. Future research should further explore targeted interventions addressing distinct personality traits associated with different substance use disorders.

## Data availability

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Received: 11 June 2025; Accepted: 27 October 2025

Published online: 26 November 2025

## References

- Power, R. A. & Pluess, M. Heritability estimates of the big five personality traits based on common genetic variants. *Transl Psychiatry*. **5**, e604. <https://doi.org/10.1038/tp.2015.96> (2015).
- Oreland, L. et al. Personality as an intermediate phenotype for genetic dissection of alcohol use disorder. *J. Neural Transm.* **125**, 107–130. <https://doi.org/10.1007/s00702-016-1672-9> (2018).
- Gerl, C., Stieger, M. & Allemand, M. Developmental changes in personality traits. In *Encyclopedia of Personality and Individual Differences* (eds Zeigler-Hill, V. & Shackelford, T. K.) 1083–1092 (Springer, 2020).
- Mohn, C. et al. Marginal relationship between affective dispositions and neurocognitive function in patients with schizophrenia spectrum disorders. *Nord J. Psychiatry*. **75**, 344–350. <https://doi.org/10.3389/fpsy.2021.648108> (2021).
- Moraleda, E. et al. Personality traits among the various profiles of substance use disorder patients: new evidence using the DSM-5 section III framework. *Eur. Addict. Res.* **25**, 238–247. <https://doi.org/10.1159/000496112> (2019).
- Parmar, A. & Kalojiya, G. Comorbidity of personality disorder among substance use disorder patients: a narrative review. *Indian J. Psychol. Med.* **40**, 517–527 (2018).
- Walton, K. E. & Pavlos, S. R. Personality theory and psychopathology. In *International Encyclopedia of the Social & Behavioral Sciences* 914–919 (Elsevier, 2015).
- Ball, S. A. Personality traits, problems, and disorders: clinical applications to substance use disorders. *J. Res. Pers.* **39**, 84–102. <https://doi.org/10.1016/j.jrp.2004.11.003> (2005).
- Cloninger, C. R. A Psychobiological model of temperament and character. *Arch. Gen. Psychiatry*. **50**, 975–990 (1993).
- McCrae, R. R. & Costa, P. T. *Personality in Adulthood: A Five-Factor Theory Perspective* (Taylor & Francis, 2003).
- Gillespie, N. A. et al. The genetic and environmental relationship between cloninger's dimensions of temperament and character. *Pers. Individ. Differ.* **35**, 1931–1946 (2003).
- Cloninger, C. R., Przybeck, T. R. & Svrakic, D. M. *The Temperament and Character Inventory-Revised* (1999).
- Pelissolo, A. et al. The temperament and character Inventory-Revised (TCI-R): psychometric characteristics of the French version. *Acta Psychiatr. Scand.* **112**, 126–133. <https://doi.org/10.1111/j.1600-0447.2005.00539.x> (2005).
- Dzamonja-Ignjatovic, T. et al. Cross-cultural validation of the revised temperament and character inventory: Serbian data. *Compr. Psychiatry*. **51**, 649–655. <https://doi.org/10.1016/j.comppsy.2010.03.001> (2010).
- Schneider, R. et al. Temperament and character traits associated with the use of alcohol, cannabis, cocaine, benzodiazepines, and hallucinogens: evidence from a large Brazilian web survey. *Braz J. Psychiatry*. **37**, 31–39 (2015).
- Foulds, J. et al. Dimensional personality traits and alcohol treatment outcome: a systematic review and meta-analysis. *Addiction* **112**, 1345–1357. <https://doi.org/10.1111/add.13768> (2017).
- Ismael, F. & Baltieri, D. A. Role of personality traits in cocaine craving throughout an outpatient psychosocial treatment program. *Braz J. Psychiatry*. **36**, 24–31. <https://doi.org/10.1590/1516-4446-2013-1174> (2014).
- Le Bon, O. et al. Personality profile and drug of choice: a multivariate analysis using cloninger's TCI on heroin addicts, alcoholics, and a random population group. *Drug Alcohol Depend.* **73**, 175–182 (2004).
- Milivojevic, D. et al. Temperament and character modify risk of drug addiction and influence choice of drugs. *Am. J. Addict.* **21**, 462–467 (2012).
- McCrae, R. R. & Terracciano, A. Personality profiles of cultures Project. Personality profiles of cultures: aggregate personality traits. *J. Pers. Soc. Psychol.* **89**, 407–425 (2005).
- Chen, F. et al. Examining the relation of personality factors to substance use disorder by explanatory item response modeling of DSM-5 symptoms. *PLOS ONE*. **14**, e0217630 (2019).
- Kamal, P. et al. A follow-up study of opioid dependent patients to assess their personality profile and to find association of personality traits with treatment outcome. *J. Evid. Based Med. Healthc.* **7**, 730–733 (2020).
- Kroencke, L. et al. How does substance use affect personality development? Disentangling between- and within-person effects. *Soc. Psychol. Personal Sci.* **12**, 517–527 (2021).
- Lee, K. H. & Yen, C. F. The relationships between depression, neuroticism, and attitudes (NDA model) in heroin abusers in Taiwan. *Am. J. Addict.* **27**, 139–143 (2018).
- Suchanek, A. et al. Dopamine receptor DRD2 gene rs1076560, personality traits and anxiety in the polysubstance use disorder. *Brain Sci.* **10**, 1 (2020).
- Zilberman, N. et al. Personality profiles of substance and behavioral addictions. *Addict. Behav.* **82**, 174–181. <https://doi.org/10.1016/j.addbeh.2018.03.005> (2018).
- Kornør, H. & Nordvik, H. Five-factor model personality traits in opioid dependence. *BMC Psychiatry*. **7**, 37 (2007).
- Malouff, J. M. et al. Alcohol involvement and the five-factor model of personality: A meta-analysis. *J. Drug Educ.* **37**, 277–294 (2007).
- Kotov, R. et al. Linking big personality traits to anxiety, depressive, and substance use disorders: A meta-analysis. *Psychol. Bull.* **136**, 768–821 (2010).
- Raketic, D. et al. Five-factor model personality profiles: the differences between alcohol and opiate addiction among females. *Psychiatr. Danub.* **29**, 74–80 (2017).
- Wingo, T. et al. Novelty seeking and drug addiction in humans and animals: from behavior to molecules. *J. Neuroimmune Pharmacol.* **11**, 456–470. <https://doi.org/10.1007/s11481-016-9663-7> (2016).
- Ávila Escribano, J. J. et al. Capacidad de predicción Del inventario de Temperamento y carácter de Cloninger (TCI-R) En La evolución de Los Trastornos Por Uso de alcohol. *Adicciones* **28**, 136 (2016).
- Wang, S. C. et al. Opioid addiction, genetic susceptibility, and medical treatments: A review. *Int. J. Mol. Sci.* **20**, 1 (2019).
- Soto, C. J. & John, O. P. Development of big five domains and facets in adulthood: Mean-level age trends and broadly versus narrowly acting mechanisms. *J. Pers.* **80**, 881–914 (2012).
- Roberts, B. W. et al. Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychol. Bull.* **132**, 1–25 (2006).
- Rahimian Boogar, I. et al. Attitude to substance abuse: do personality and socio-demographic factors matter? *Int. J. High. Risk Behav. Addict.* **3**, e16712 (2014).
- Chapman, B. P. et al. Personality, socioeconomic status, and all-cause mortality in the united States. *Am. J. Epidemiol.* **171**, 83–92 (2010).
- Terracciano, A. et al. Five-factor model personality profiles of drug users. *BMC Psychiatry*. **8**, 22. <https://doi.org/10.1186/1471-244X-8-22> (2008).
- Becker, J. B. et al. Sex differences, gender and addiction. *J. Neurosci. Res.* **95**, 136–147 (2017).

40. Han, B. et al. Reported heroin use, use disorder, and injection among adults in the United States, 2002–2018. *JAMA* **323**, 568–571 (2020).
41. Corsi, D. J. & Murphy, M. S. Q. The effects of opioids on female fertility, pregnancy and the breastfeeding mother–infant dyad: A review. *Basic. Clin. Pharmacol. Toxicol.* **128**, 635–641 (2021).
42. Volkow, N. D. Opioids in pregnancy. *BMJ* **352**, i19 (2016).
43. Erol, A. & Karpyak, V. M. Sex and gender-related differences in alcohol use and its consequences: contemporary knowledge and future research considerations. *Drug Alcohol Depend.* **156**, 1–13 (2015).
44. Becker, J. B. & Koob, G. F. Sex differences in animal models: focus on addiction. *Pharmacol. Rev.* **68**, 242–263 (2016).
45. Benoit, T. & Jauffret-Roustide, M. *Improving the Management of Violence Experienced by Women Who Use Psychoactive Substances* (Council Europe, 2016).
46. Arpa, S. *Women Who Use Drugs: Issues, Needs, Responses, Challenges and Implications for Policy and Practice* (European Union, 2017).
47. Đoković–Papić, D. et al. *Women and Men in the Republic of Serbia* (Statistical Office of the Republic of Serbia, 2017).
48. Sanchis-Segura, C. & Becker, J. B. Why we should consider sex (and study sex differences) in addiction research. *Addict. Biol.* **21**, 995–1006 (2016).
49. Desu, M. M. & Raghavarao, D. *Sample Size Methodology* (Academic Press, 1990).
50. Cloninger, C. R. et al. The complex genetics and biology of human temperament: a review of traditional concepts in relation to new molecular findings. *Transl Psychiatry*. **9**, 1 (2019).
51. Costa, P. T. & McCrae, R. R. The five-factor model of personality and its relevance to personality disorders. *J. Pers. Disord.* **6**, 343–359 (1992).
52. Costa, P. T. & McCrae, R. R. The revised NEO personality inventory (NEO-PI-R). In *The SAGE Handbook of Personality Theory and Assessment*, vol. 2, 179–198 (SAGE, 2008).
53. Djurić Jočić, D. Correlation of the Rorschach method and the NEO PI-R questionnaire. *Rorschachiana* **27**, 11–29 (2005).
54. Pilatti, A. et al. Contribution of time of drinking onset and family history of alcohol problems in alcohol and drug use behaviors in Argentinean college students. *Alcohol Alcohol.* **49**, 128–137 (2014).
55. Cloninger, C. R. et al. Type I and type II alcoholism: an update. *Alcohol Health Res. World.* **20**, 18–23 (1996).
56. Dubey, C. et al. Five factor correlates: A comparison of substance abusers and non-substance abusers. *J. Indian Acad. Appl. Psychol.* **36**, 1 (2010).
57. Flory, K. et al. The relations among personality, symptoms of alcohol and marijuana abuse, and symptoms of comorbid psychopathology: results from a community sample. *Exp. Clin. Psychopharmacol.* **10**, 425–434 (2002).
58. Sher, K. J. et al. Personality and substance use disorders: A prospective study. *J. Consult Clin. Psychol.* **68**, 818–829 (2000).
59. Delić, M. et al. Association of the five-factor model personality traits and opioid addiction treatment outcome. *Psychiatr Danub.* **29**, 289–291 (2017).
60. United Nations Office on Drugs and Crime & World Health Organization (UNODC/WHO). *International Standards for the Treatment of Drug Use Disorders*. [https://www.unodc.org/documents/drug-prevention-and-treatment/UNODC-WHO\\_International\\_Standards\\_Treatment\\_Drug\\_Use\\_Disorders\\_April\\_2020.pdf](https://www.unodc.org/documents/drug-prevention-and-treatment/UNODC-WHO_International_Standards_Treatment_Drug_Use_Disorders_April_2020.pdf) (UNODC/WHO, 2020).
61. National Institute for Health and Care Excellence (NICE). *Alcohol-Use Disorders: Diagnosis, Assessment and Management (Clinical Guideline CG115)*. <https://www.nice.org.uk/guidance/cg115> (NICE, 2011).
62. American Society of Addiction Medicine (ASAM). The ASAM National practice guideline for the treatment of opioid use disorder: 2020 focused update. *J. Addict. Med.* **14**, 1–91. <https://doi.org/10.1097/ADM.0000000000000633> (2020).
63. Bahji, A. et al. Neurobiology and symptomatology of post-acute alcohol withdrawal: A mixed-studies systematic review. *J. Stud. Alcohol Drugs*. **83**, 461–469 (2022).
64. Boulze, I. et al. Prolonged abstinence and changes in alcoholic personality: A NEO PI-R study. *Psychology* **5**, 312–319 (2014).
65. Volkow, N. D. et al. Neurobiologic advances from the brain disease model of addiction. *N Engl. J. Med.* **374**, 363–371 (2016).
66. Piedmont, R. L. et al. The utility of the revised NEO personality inventory in an outpatient, drug rehabilitation context. *Psychol. Addict. Behav.* **13**, 213–226 (1999).
67. Carter, J. A. et al. Short-term stability of NEO-PI-R personality trait scores in opioid-dependent outpatients. *Psychol. Addict. Behav.* **15**, 255–260 (2001).

## Author contributions

Conceptualization: Diana Raketić, Jasmina Barišić and Srđan Milovanović; Methodology: Diana Raketić and Srđan Milovanović; Formal analysis: Diana Raketić and Nikola Lalović; Investigation: Diana Raketić; Validation: Diana Raketić, Nikola Lalović, Jasmina Barišić, Ivan Čelić; Visualization: Diana Raketić and Nikola Lalović; Writing - original draft preparation: Diana Raketić and Jasmina Barišić; Writing - review and editing: Diana Raketić, Nikola Lalović, Jasmina Barišić, Ivan Čelić and Srđan Milovanović; Supervision: Srđan Milovanović.

## Declarations

## Competing interests

The authors declare no competing interests.

## Ethical approval and consent to participate

This study was performed in line with the principles of the 1964 Helsinki Declaration and its later amendments. The study protocol was reviewed and approved by the Ethical Board of the Special Hospital for Addiction Disorders in Belgrade, No.2604/2012]. Informed consent was obtained from all participants before data collection.

## Additional information

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1038/s41598-025-25967-5>.

**Correspondence** and requests for materials should be addressed to N.L.

**Reprints and permissions information** is available at [www.nature.com/reprints](http://www.nature.com/reprints).

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

© The Author(s) 2025